Claims

1. 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a salt thereof.

2. 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof.

3. 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide.

4. A compound or salt as claimed in claim 2, wherein the pharmaceutically acceptable salt includes a pharmaceutically acceptable acid addition salt.

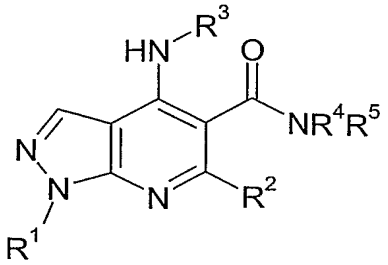
5. A compound or salt as claimed in claim 2, wherein the pharmaceutically acceptable salt is a pharmaceutically acceptable acid addition salt.

6. A compound or salt as claimed in claim 4 or 5, wherein the pharmaceutically acceptable acid addition salt has been formed by combination of 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide with a pharmaceutically acceptable acid having a pKa of 1.5 or less.

7. A compound or salt as claimed in claim 4 or 5, wherein the pharmaceutically acceptable acid addition salt of the 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide comprises a hydrobromide, hydrochloride, sulfate, nitrate, phosphate, p-toluenesulfonate, benzenesulfonate, methanesulfonate, ethanesulfonate, or naphthalenesulfonate salt thereof.

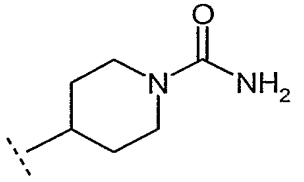
8. 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide hydrochloride.

9. A method of preparing a compound of formula (IA), or a salt thereof:



(IA)

wherein:
R^1 is ethyl;
R^2 is a hydrogen atom (H);
R^3 is an N-aminocarbonyl-piperidinyl group of sub-formula (bb) which is not substituted on a ring carbon:

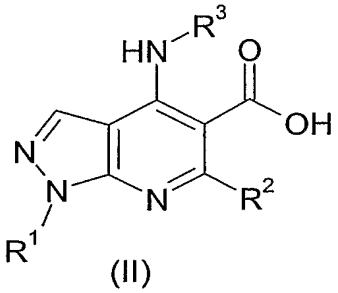


(bb) ;

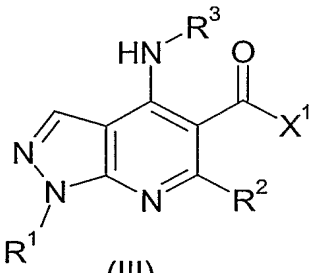
R^4 is a hydrogen atom (H);
and R^5 is (3,4-dimethylphenyl)methyl;

wherein the method comprises:

(a) converting a compound of formula (II) into an activated compound of formula (III) wherein X^1 = a leaving group substitutable by an amine:



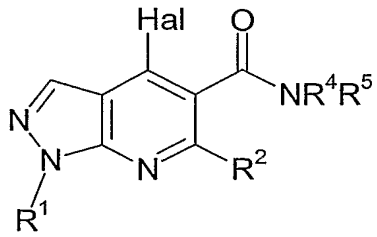
(II)



(III)

and subsequently reacting the activated compound of formula (III) with an amine of formula R^4R^5NH; or

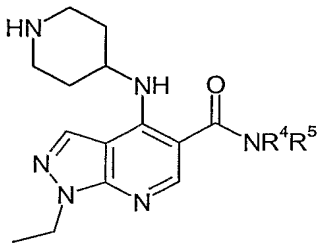
(b) reacting a compound of formula (VIIA):



(VIIA)

wherein Hal is a chlorine, bromine or iodine atom,
with an amine of formula R^3NH_2 or a salt thereof; or

(c) reacting a compound of formula (X) or a salt thereof



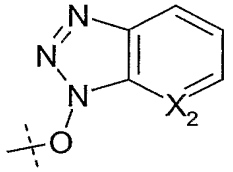
(X)

with a urea-forming reagent capable of converting the (4-piperidinyl)amino group in the compound of formula (X) into a [(1-aminocarbonyl)-4-piperidinyl]amino group;

and, in the case of (a), (b) or (c), optionally converting the compound of formula (I) into a salt thereof; or

(g) in a method of preparing a pharmaceutically acceptable salt of the compound of formula (I), converting the compound of formula (I) or a salt thereof into the desired pharmaceutically acceptable salt thereof.

10. A method as claimed in claim 9, wherein the activated compound of formula (III) is the acid chloride, or the activated compound of formula (III) is an activated ester



X_2 = CH or N

wherein the leaving group X^1 is .

11. A method as claimed in claim 9 or 10, wherein, in formula (VIIA), Hal is a bromine atom or a chlorine atom.

12. A method as claimed in claim 9, 10 or 11, wherein in step (c) the urea-forming reagent is trimethylsilyl isocyanate.

13. 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof for use as an active therapeutic substance in in a mammal such as a human.

14. A compound or salt as claimed in claim 13, for use in the treatment and/or prophylaxis of an inflammatory and/or allergic disease or cognitive impairment or depression in a mammal such as a human.

15. A compound or salt as claimed in claim 13, for use in the treatment and/or prophylaxis of atopic dermatitis in a human.

16. A compound or salt as claimed in claim 13, for use by external topical administration in the treatment and/or prophylaxis of atopic dermatitis in a human.

17. The use of 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof in the manufacture of a medicament for the treatment and/or prophylaxis of an inflammatory and/or allergic disease, cognitive impairment or depression in a mammal such as a human.

18. The use as claimed in claim 17, wherein the medicament is for the treatment and/or prophylaxis of chronic obstructive pulmonary disease (COPD), asthma, rheumatoid arthritis, allergic rhinitis, psoriasis or atopic dermatitis in a mammal such as a human.

19. The use as claimed in claim 17, wherein the medicament is for the treatment and/or prophylaxis is of atopic dermatitis in a mammal.

20. The use as claimed in claim 19, wherein the mammal is a human.

21. The use as claimed in claim 19 or 20, wherein the medicament is for external topical administration to the mammal.

22. A method of treatment and/or prophylaxis of an inflammatory and/or allergic disease, cognitive impairment or depression in a mammal such as a human in need thereof, which method comprises administering to the mammal a therapeutically effective amount of 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof.

23. A method of treatment and/or prophylaxis of atopic dermatitis in a mammal in need thereof, which method comprises administering to the mammal a therapeutically effective amount of 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof.

24. A method of treatment and/or prophylaxis of atopic dermatitis in a human in need thereof, which method comprises administering to the human a therapeutically effective amount of 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-

1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof.

25. A method as claimed in claim 23 or 24, comprising external topical administration of the compound or salt to the mammal (e.g. human).

26. A pharmaceutical composition comprising 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof, and one or more pharmaceutically acceptable carriers and/or excipients.

27. A pharmaceutical composition as claimed in claim 26, which is suitable for external topical administration to a human.

28. A pharmaceutical composition as claimed in claim 27, wherein the 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or the pharmaceutically acceptable salt thereof is present at 0.1% to 3% by weight of the composition (w/w).

29. A pharmaceutical composition as claimed in claim 27, which is an ointment comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.1% to 3% w/w;
- an oil phase (oily ointment base) present at 25% to 99% w/w;
- one or more surfactants present in total at 0.5% to 10% w/w; and
- one or more agents acting as a skin-penetration enhancer present in total at 0.5% to 50% w/w.

30. A pharmaceutical composition as claimed in claim 29, which is an ointment comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.2% to 1.5% w/w;
- an oil phase (oily ointment base) present at 50% to 80% w/w, and comprising white petrolatum present at 45 to 75% w/w, and also comprising mineral oil present at 2.5% to 15% w/w);
- one or more surfactants present in total at 3% to 10% w/w; and
- one or more hydrophilic agents acting as both a solubiliser and skin-penetration enhancer, present in total at 5% to 50% w/w;
wherein, in the ointment composition, the oil phase (oily ointment base) and the hydrophilic solubiliser/penetration-enhancer phase have been emulsified to form an ointment emulsion.

31. A pharmaceutical composition as claimed in claim 27, which is a water-in-oil cream comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.1% to 3% w/w;
- an oil phase (oily ointment base) present at 25% to 85% w/w;
- water present in 2% to 30% w/w;
- one or more surfactants present in total at 0.5% to 12% w/w; and
- one or more agents acting as a skin-penetration enhancer present in total at 0.5% to 50% w/w.

32. A pharmaceutical composition as claimed in claim 31, which is a water-in-oil cream emulsion comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.2% to 1.5% w/w;
- an oil phase (oily ointment base) present at 35% to 70% w/w, and comprising white petrolatum present at 30% to 65% w/w, and also comprising mineral oil present at 2.5% to 15% w/w;
- water present in 5% to 25% w/w;
- one or more surfactants present in total at 3% to 10% w/w; and
- one or more hydrophilic agents acting as both a solubiliser and skin-penetration enhancer, present in total at 5% to 50% w/w.

33. A pharmaceutical composition as claimed in claim 27, which is an oil-in-water cream comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.1% to 3% w/w;
- an oil phase (oily ointment base) containing one or more ingredients capable of acting as emollients, the oil phase being present at 20% to 60% w/w;
- water present in 15% to 75% w/w;
- one or more surfactants present in total at 0.5% to 12% w/w; and
- one or more agents acting as a skin-penetration enhancer, present in total at 0.5% to 50% w/w.

34. A pharmaceutical composition as claimed in claim 33, which is an oil-in-water cream emulsion comprising:
- 4-{[1-(aminocarbonyl)-4-piperidinyl]amino}-N-[(3,4-dimethylphenyl)methyl]-1-ethyl-1*H*-pyrazolo[3,4-*b*]pyridine-5-carboxamide or a pharmaceutically acceptable salt thereof present at 0.2% to 1.5% w/w;

- an oil phase (oily ointment base) containing one or more ingredients capable of acting as emollients, the oil phase being present at 30% to 55% w/w;
- water present in 15% to 50% w/w;
- one or more surfactants present in total at 3% to 10% w/w; and
- one or more hydrophilic agents acting as both a solubiliser and skin-penetration enhancer, present in total at 5% to 50% w/w;

wherein the oil phase comprises mineral oil present at 20% to 45% w/w, and/or comprises microcrystalline wax present at 5% to 25% w/w, and/or comprises a silicone such as dimethicone present at 0.5% to 10% w/w.